Run II Forward Physics

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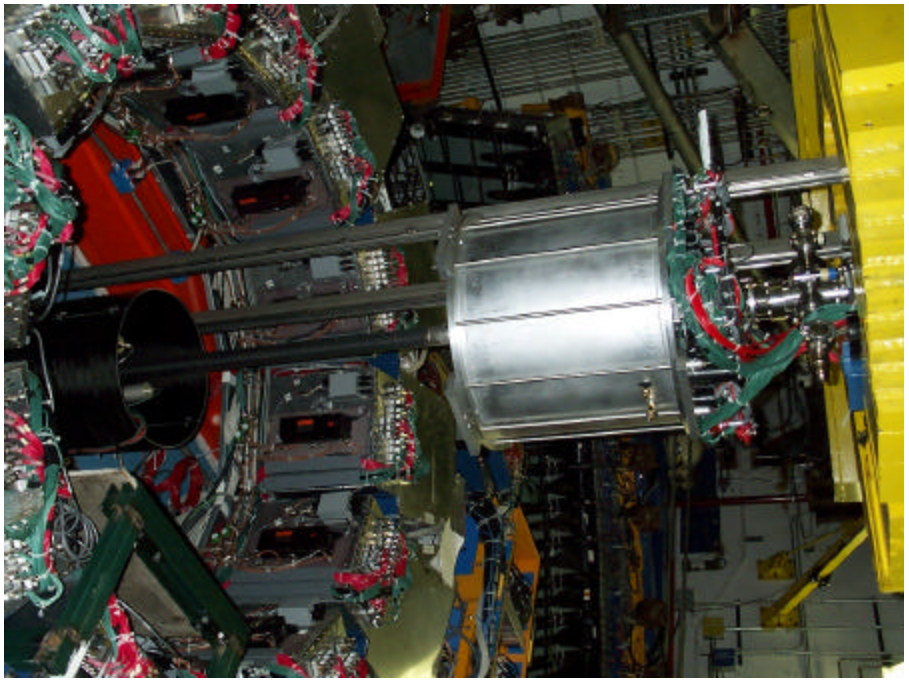
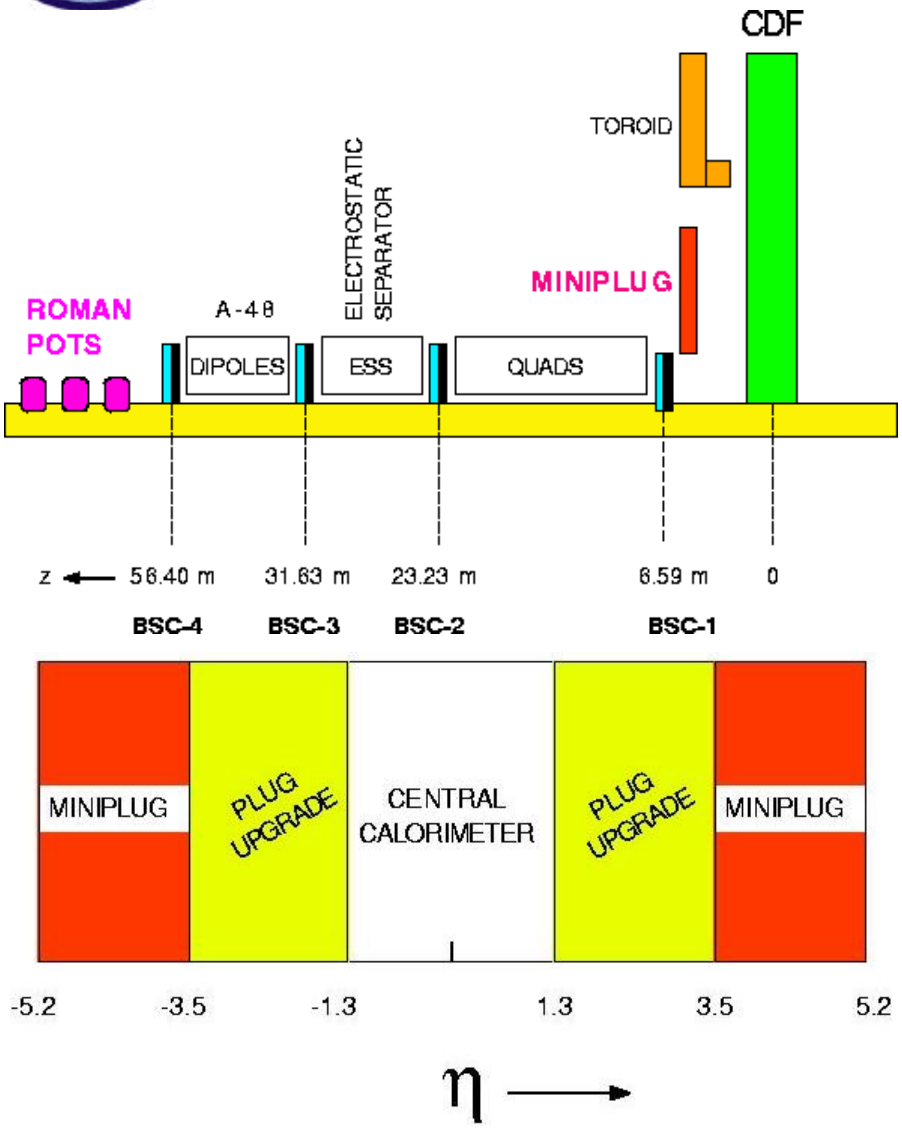
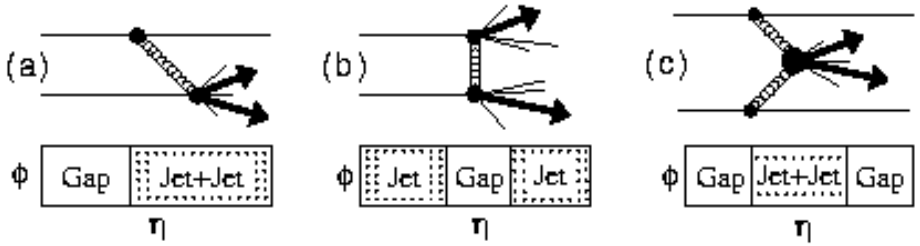
(Collaboration Meeting - Jan. 23, 2003)

- ✓ Forward Physics
- ✓ Run I and beyond
- ✓ Detectors
- ✓ Run II Data



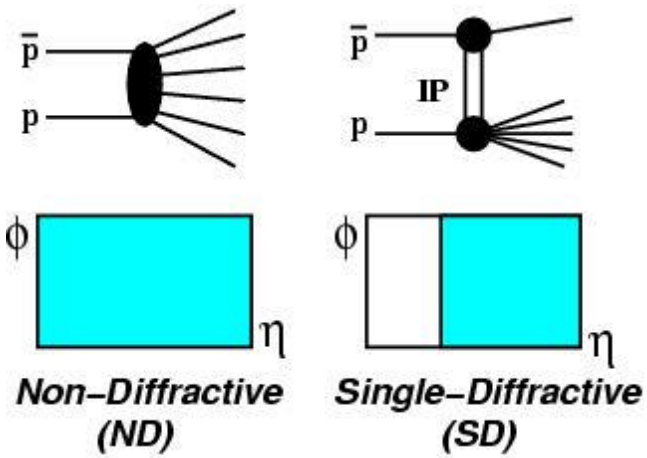
Forward Physics





- Hard Single Diffraction
- Double Diffraction
- Double Pomeron Exchange
- Forward Jets (jet-gap-jet)
- …

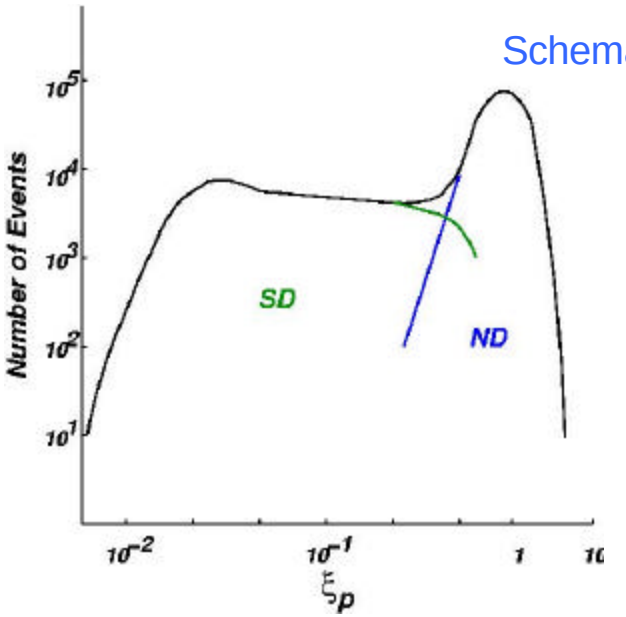
Diffractive Dijets



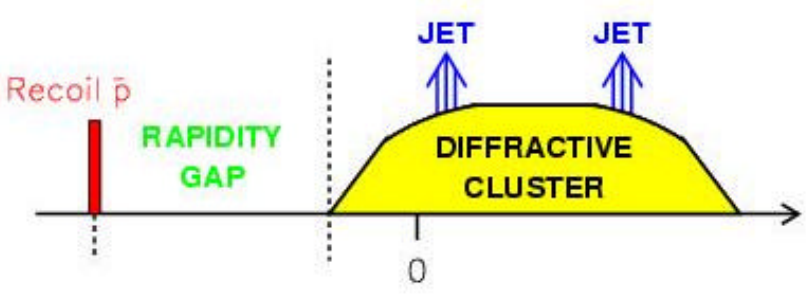
- Compare diffractive events to ND
- Measure diffractive structure function
- Calculate $R_{SD/ND}$
- DSF different in ep (Hera) and pp
- Test of QCD factorization

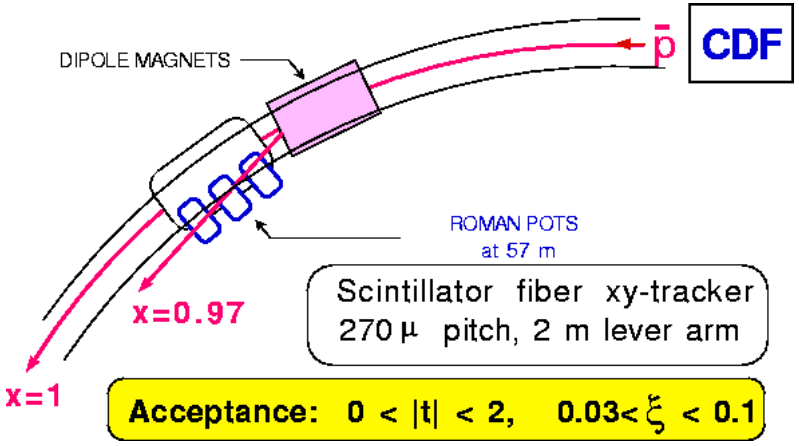
Measure ξ (momentum loss fraction)

Schematic drawing



Strategy

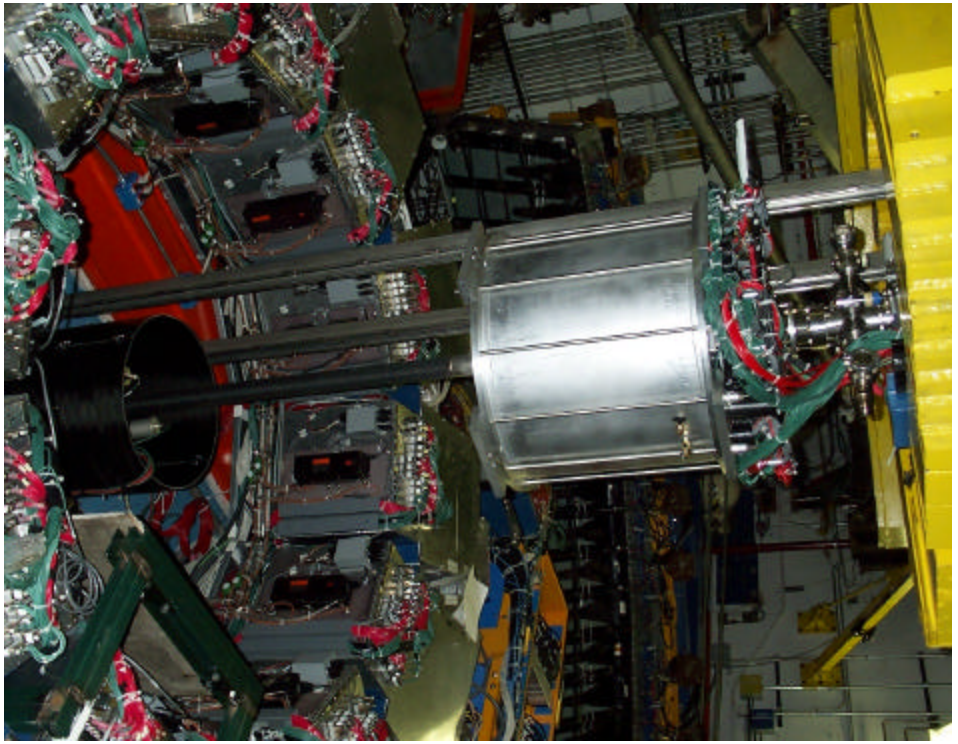




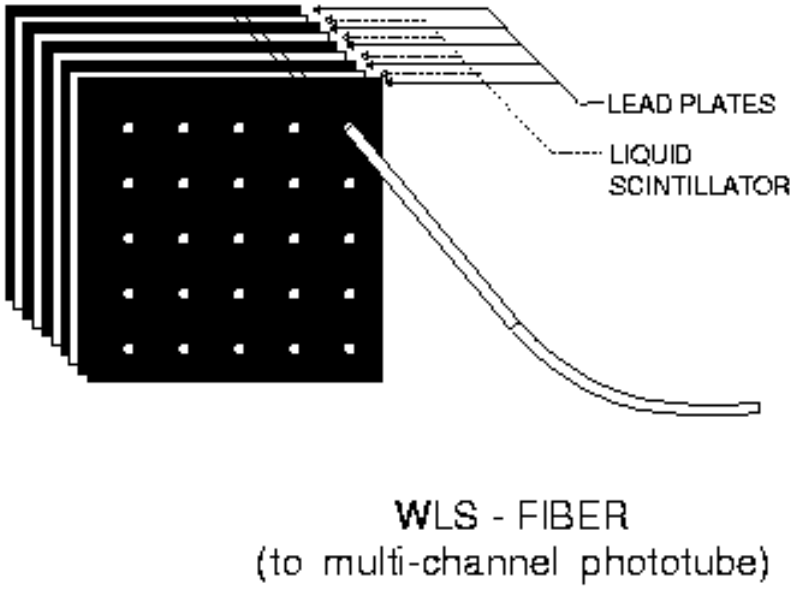
- events triggered on a leading antiproton
- Use RP + jet triggers
- Lower ξ/higher Q^2 than Run 1
- Use MP/BSC to measure event energy/gap

MiniPlugs in CDF-II

- **Extend coverage to 3.6<|h|<5.1**
- **Measure charged and neutrals**
- **Measure energy and position of both EM and hadron showers**
- **Forward jets at large rapidity**

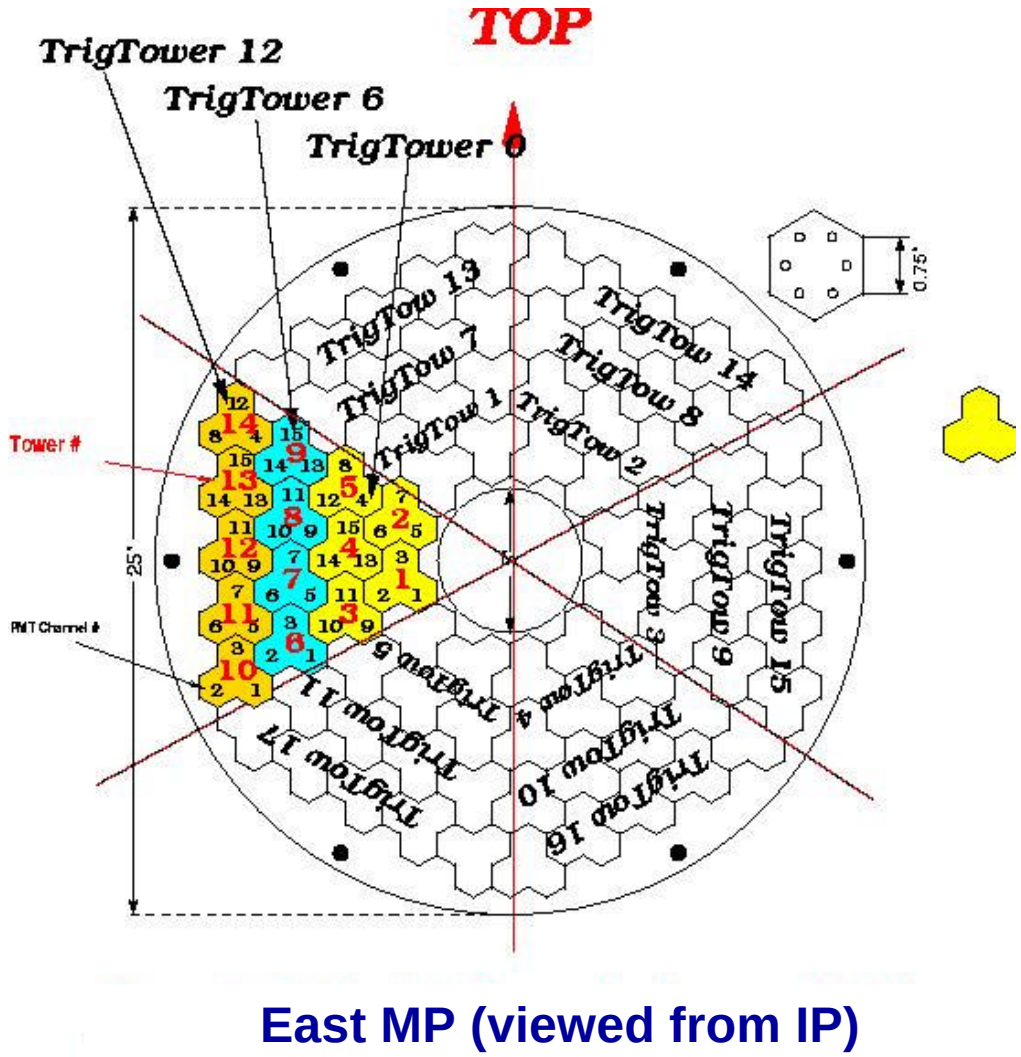


MiniPlug Conceptual Design



- Pb plates in liquid scintillator
- WLS fibers to MAPMT
- Towerless geometry (no dead regions)
- “Tower” size not fixed

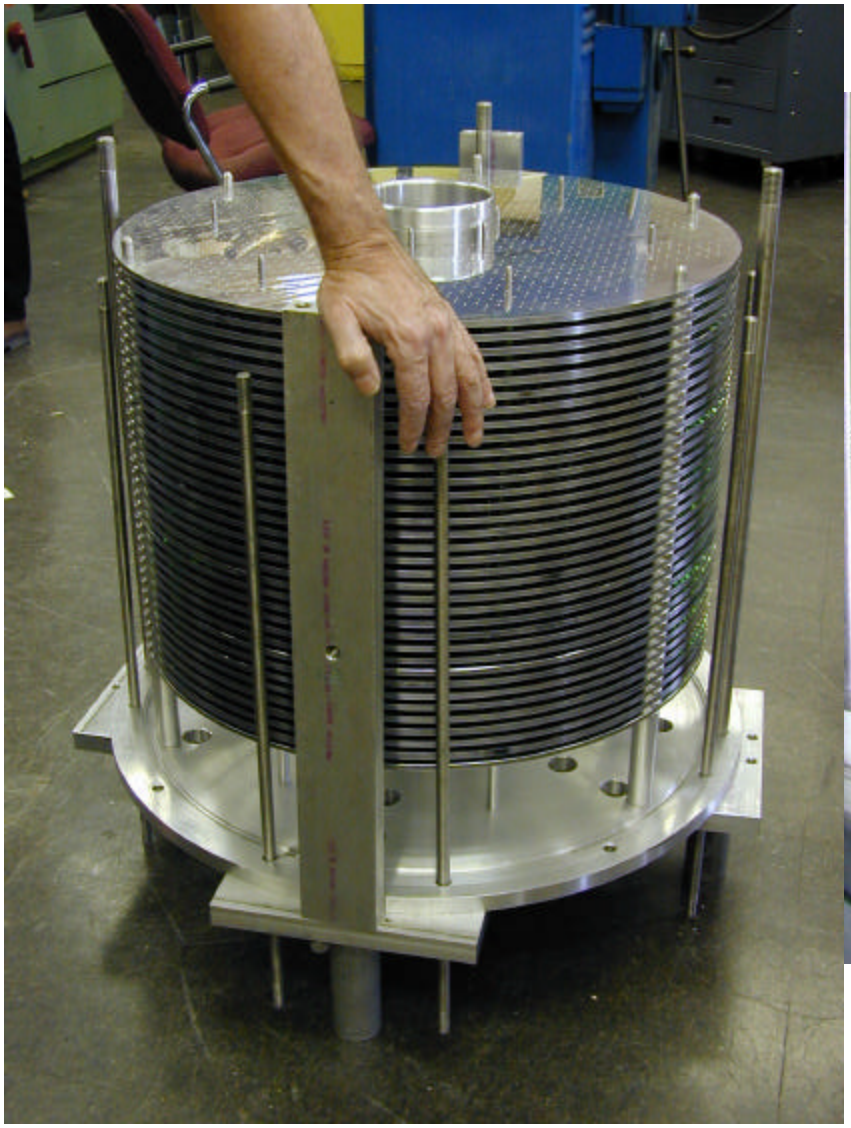
MiniPlug Design

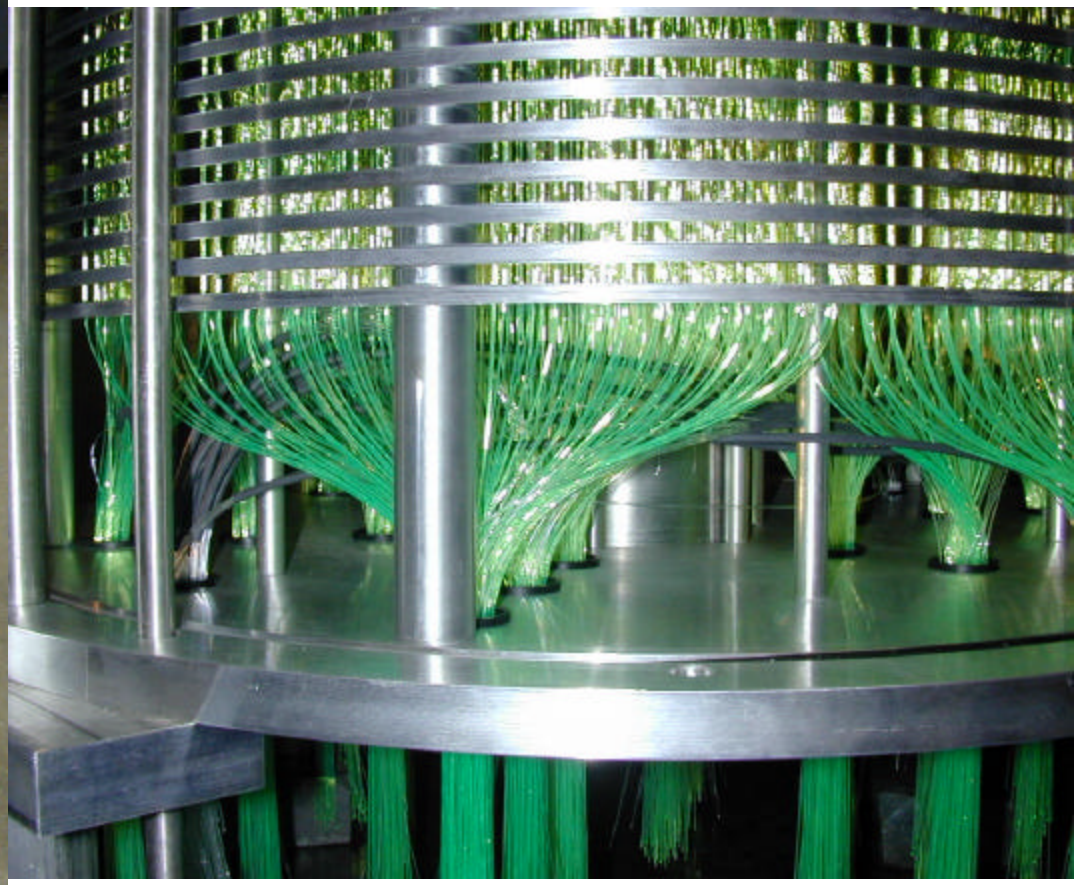


East MP (viewed from IP)

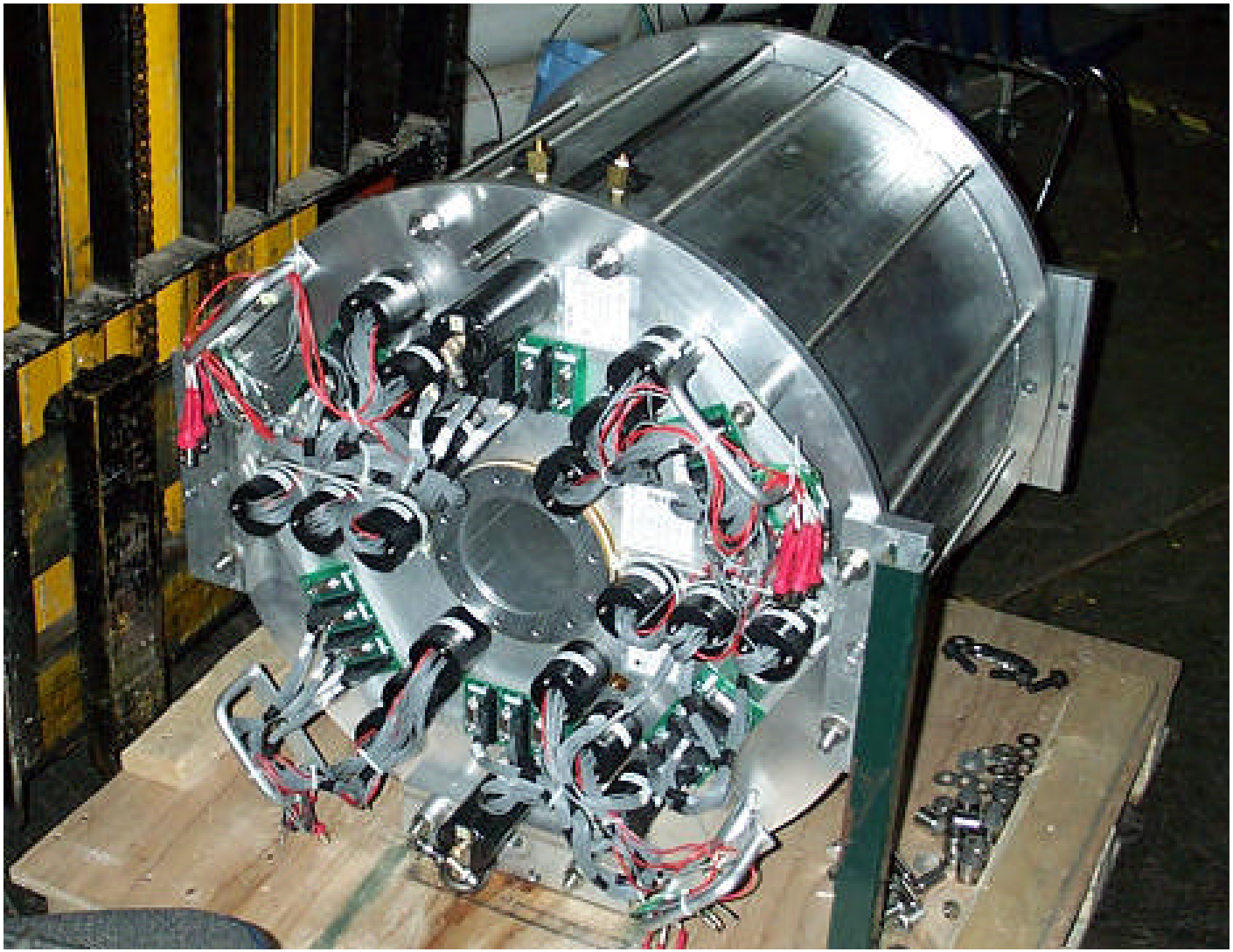
- 6 WLS fibers = **hexagon**
  - Þ 1 MAPMT pixel
- 3 MAPMT outputs added
  - Þ **84 calorimeter "towers"**
  - (to reduce electronics' cost)
- 4 h rings: **3.6<|h|<5.1**
- 18 + 18 "**trigger-towers**"
- 1 clear fiber to **LED**

MiniPlug Assembly



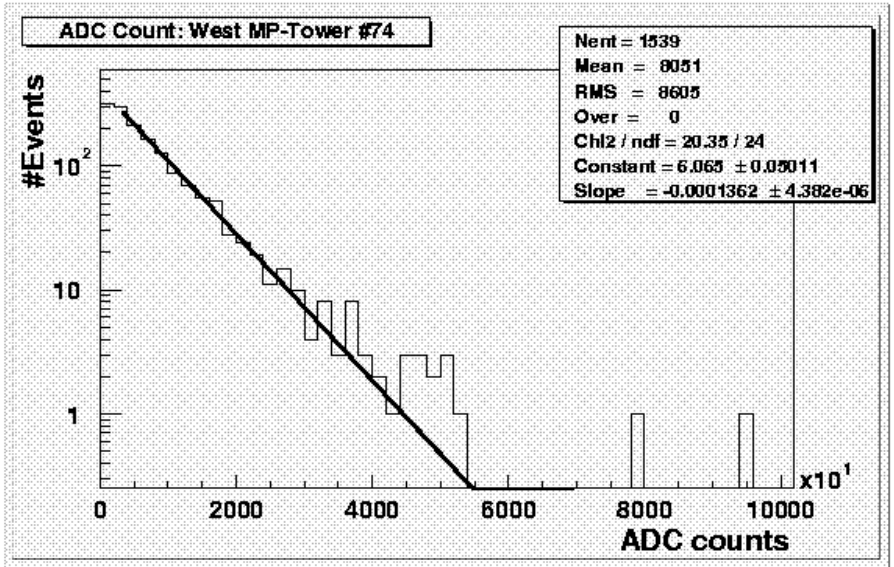


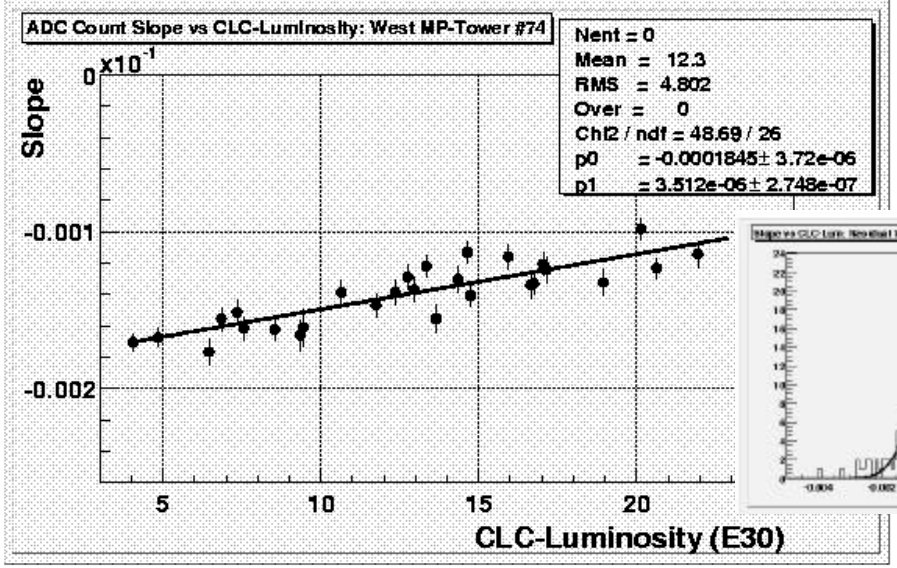
MiniPlug Assembled



MP Calibration

- Use slope from ADC distribution
- Tower-to-tower relative calibration with data/MC
- Energy scale from MC
- MC/MBR



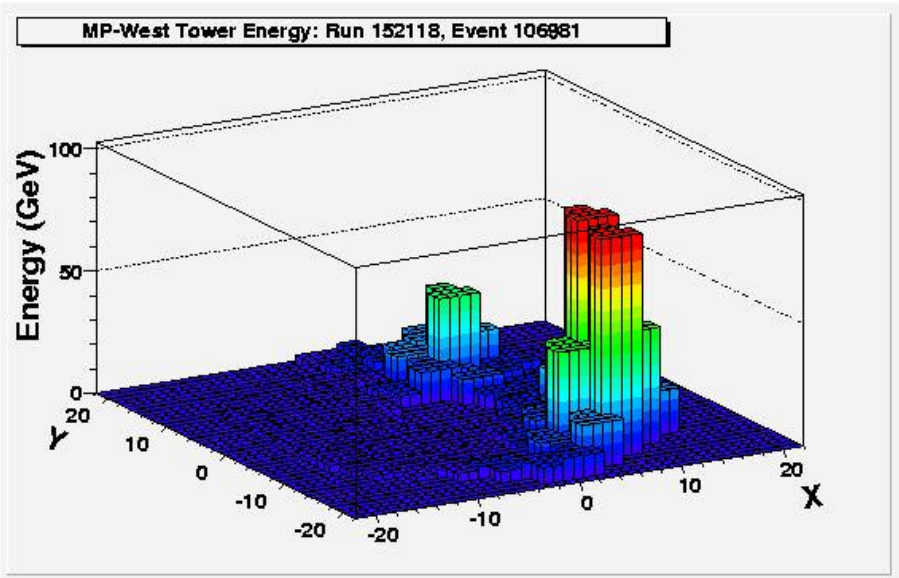


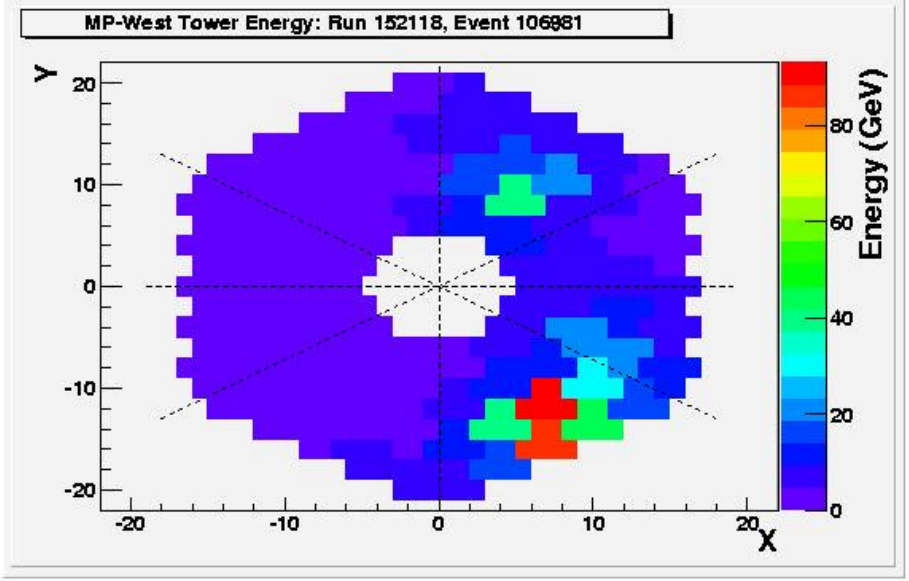
- ✓ Pile-up at high luminosity
- ✓ (Slope-Fit)/Fit ~7% for each η ring
- ✓ Time dependence (LED)

Event display

- All MP instrumented
- MP/ToF trigger timed in

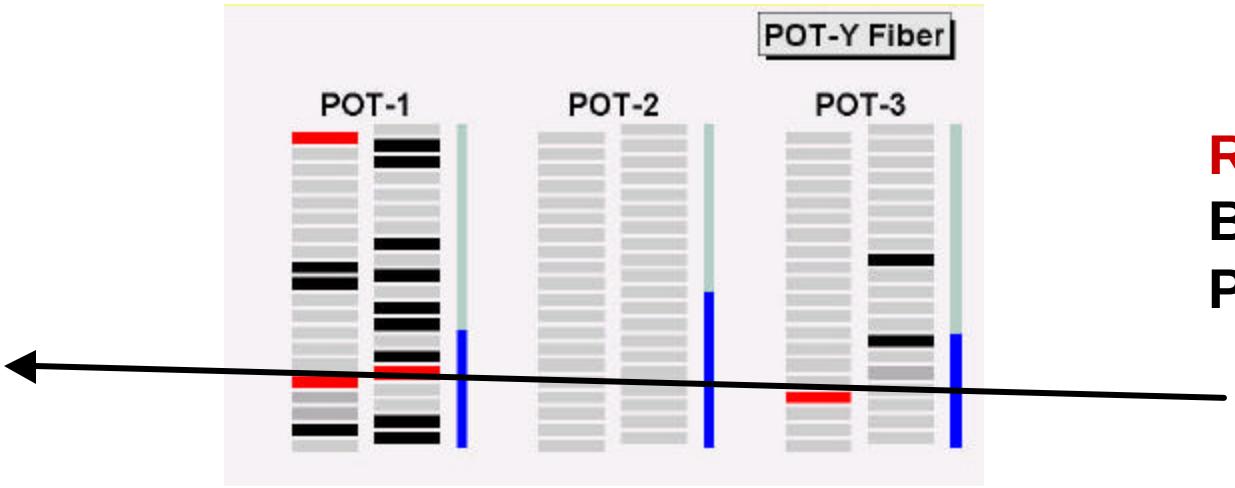
✓ Updated diffractive triggers soon (forward jets, etc.)





Detector Status

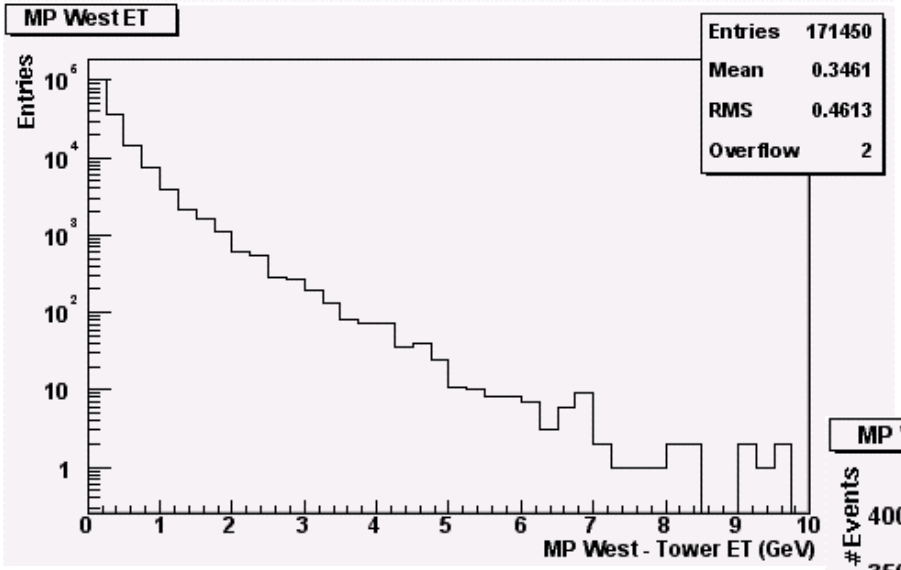
- All MP instrumented
- MP/ToF timed in the trigger (forward gaps + low multiplicity)



Red = Hit
Black = bad
Pot 2 = not instrumented

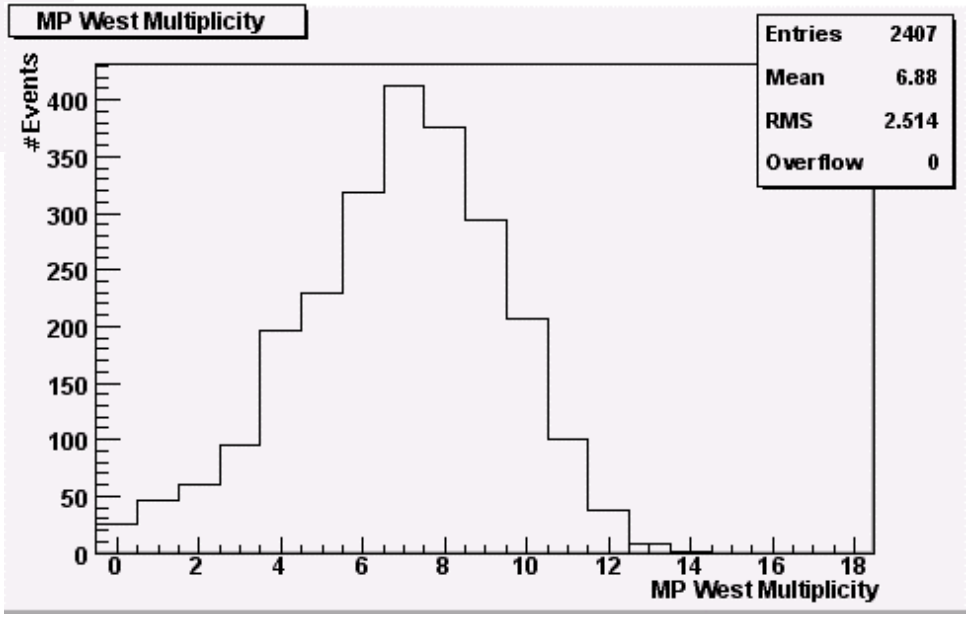
- ✓ RP fiber tracker almost fully instrumented
- ✓ Updated diffractive triggers soon

MP Data



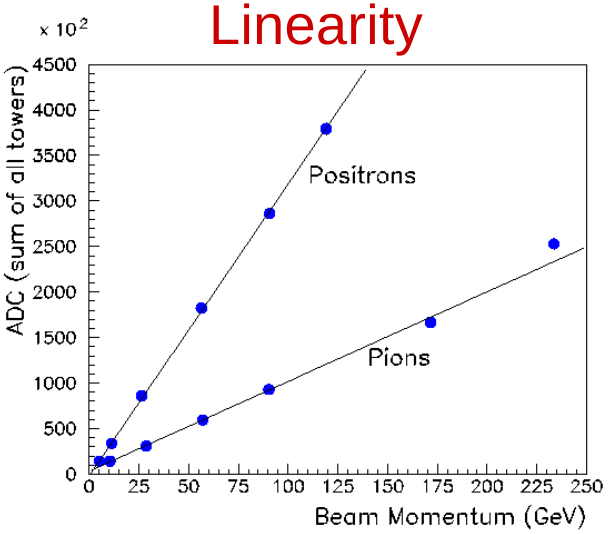
⇦ Tower E_T distribution

Particle multiplicity ~7 ⇨

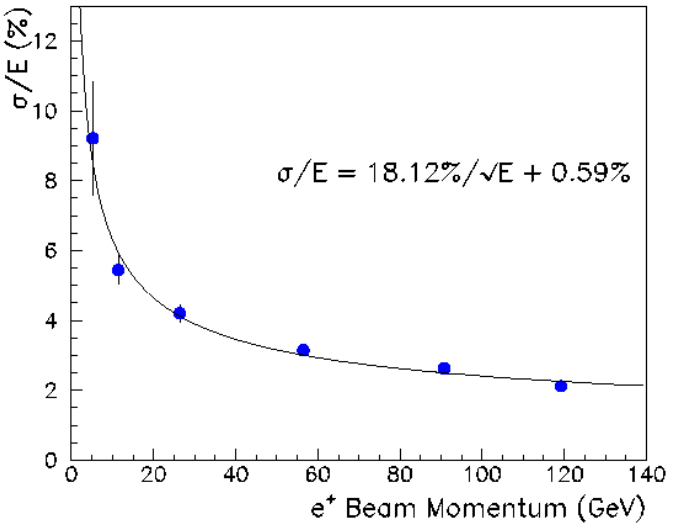


MP Prototype

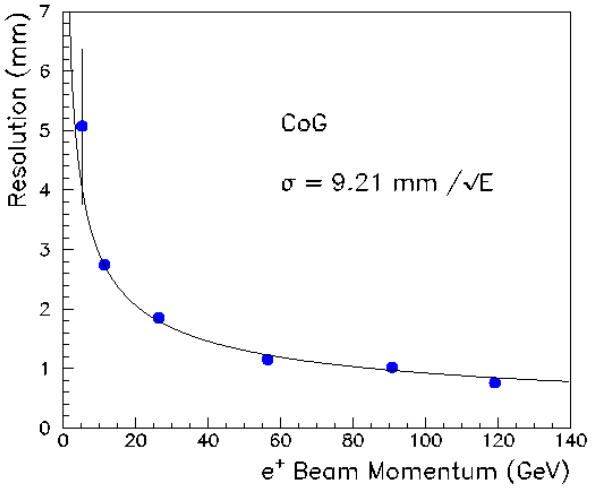
Linearity



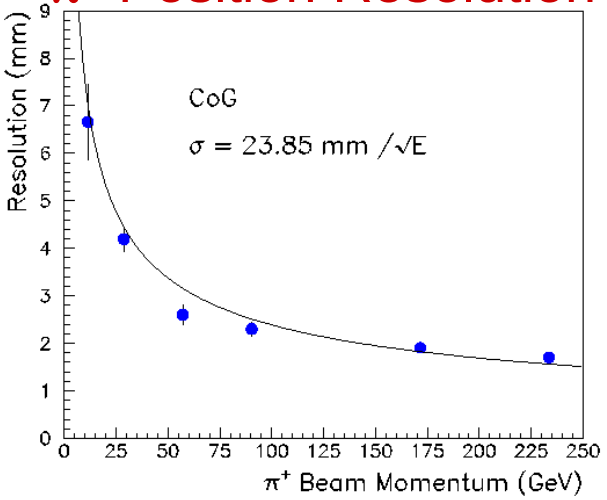
EM Energy Resolution



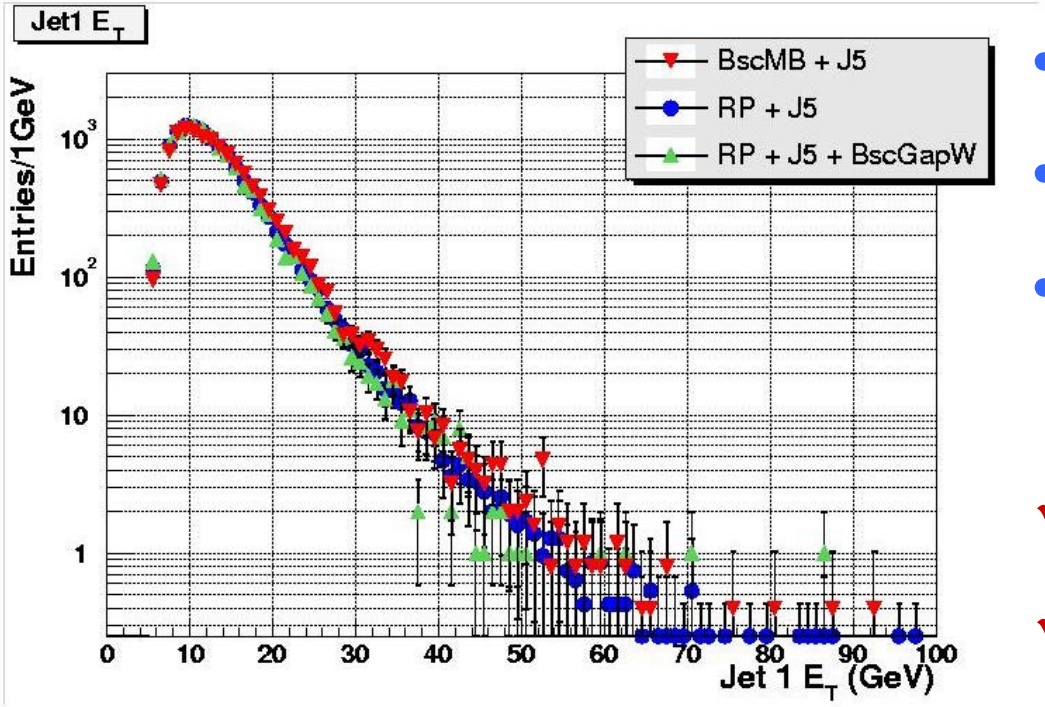
e⁺ Position Resolution



π⁺ Position Resolution



Run II Data

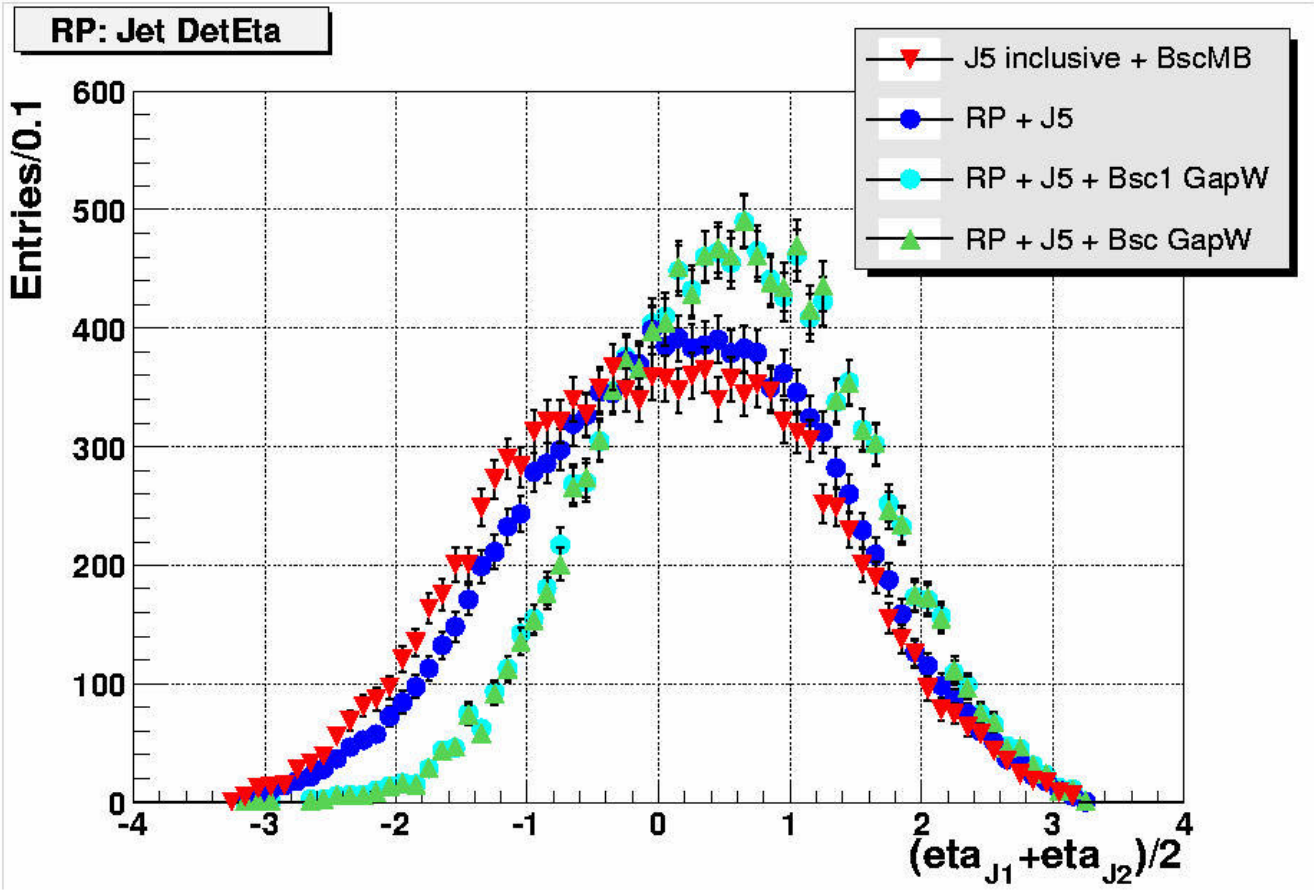


- Diffractive triggers
- Data sample ~15 pb^{-1}
- RP coincidence + Jets

✓ Higher Jet E_T than Run I

✓ Good agreement

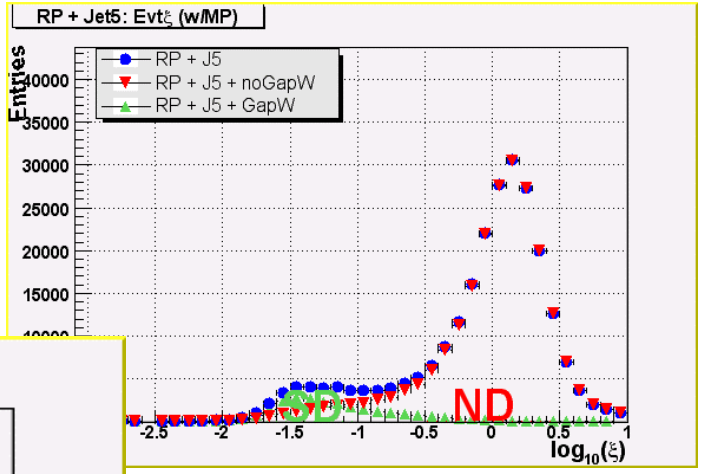
Rapidity (jet_1,jet_2)

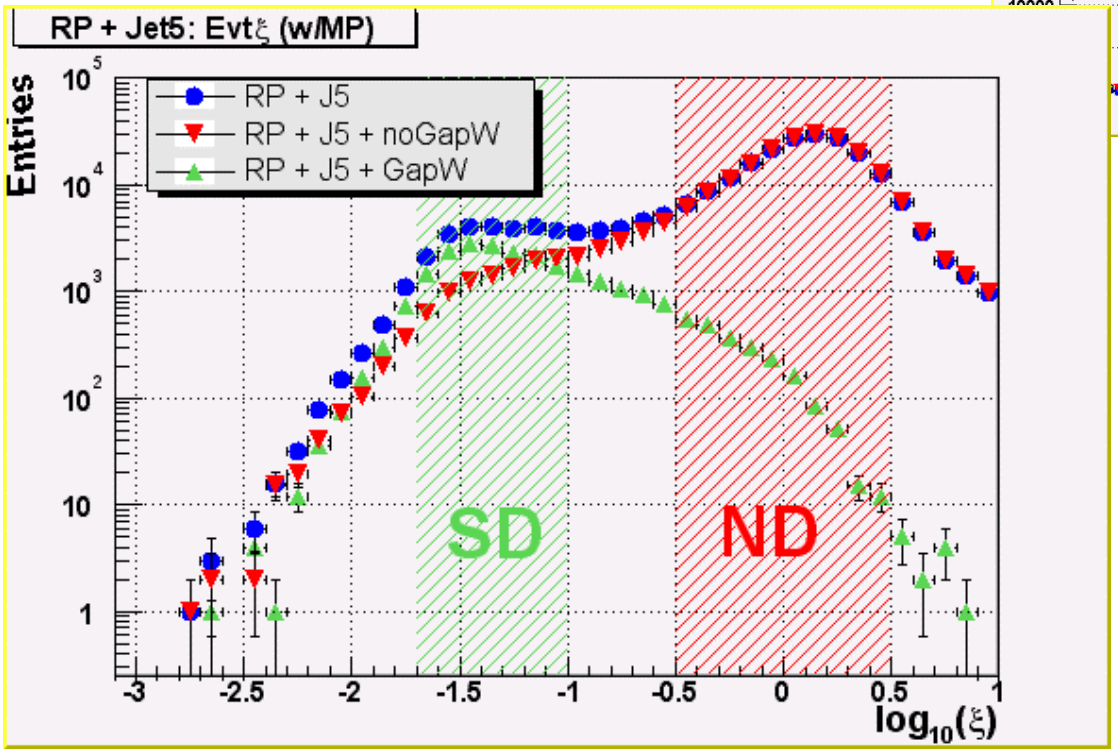


⇨ **Gap selects purer diffractive sample**

x Distribution

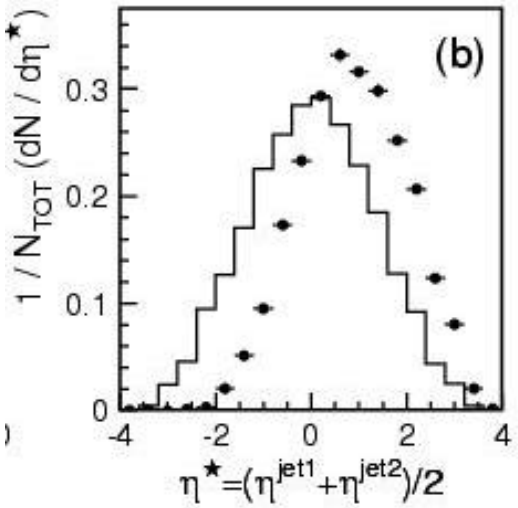
- $x = \Sigma E_T e^{-h} / \sqrt{s}$
- **Discriminate on x (SD/ND)**

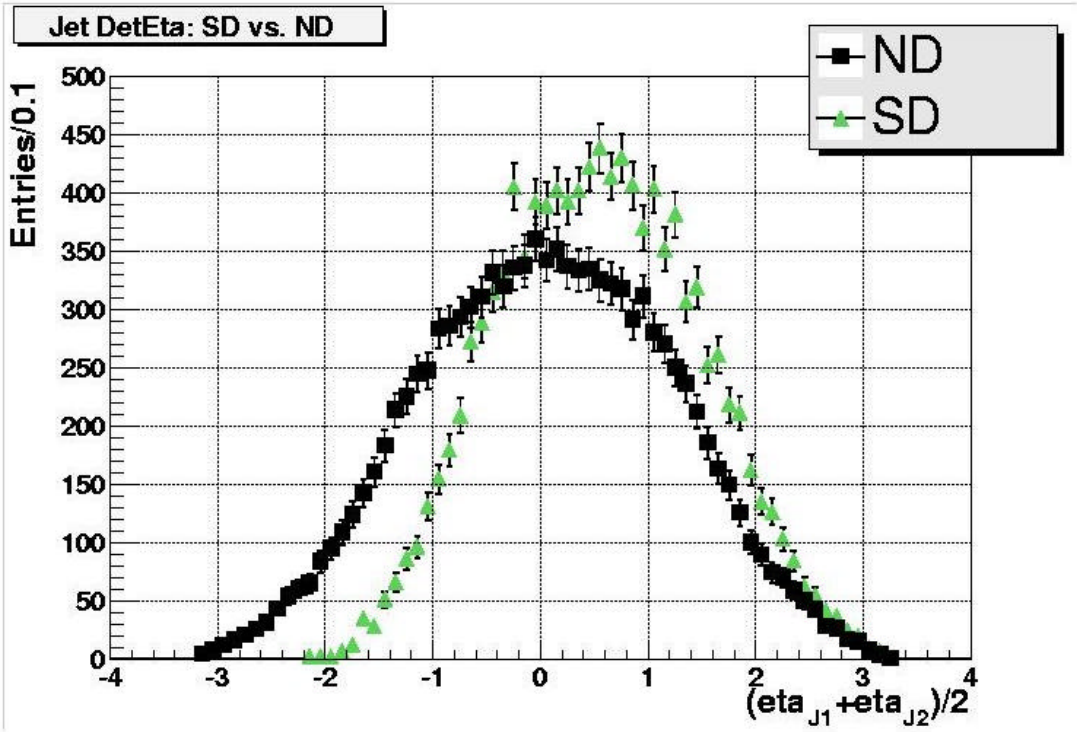




Rapidity

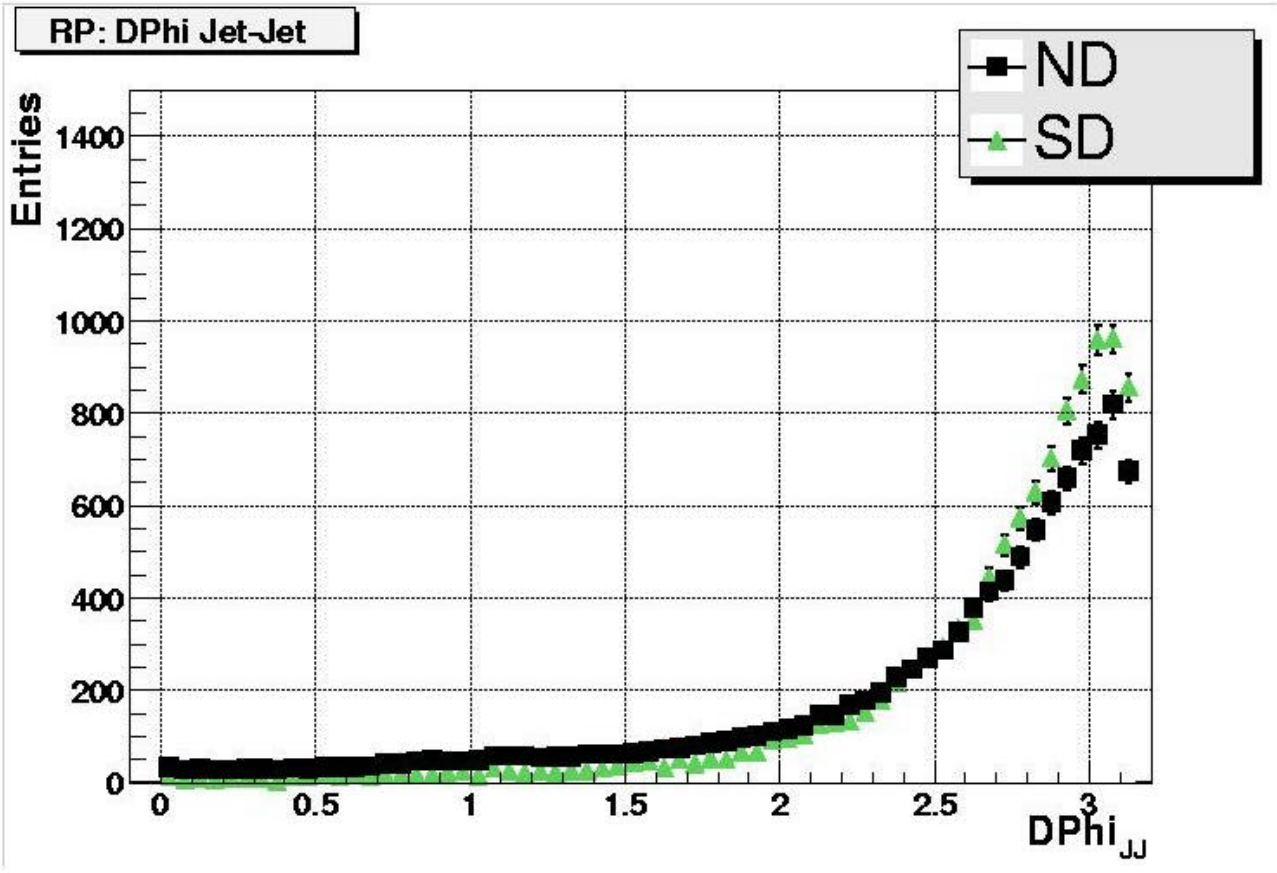
Run I PRL ⇨





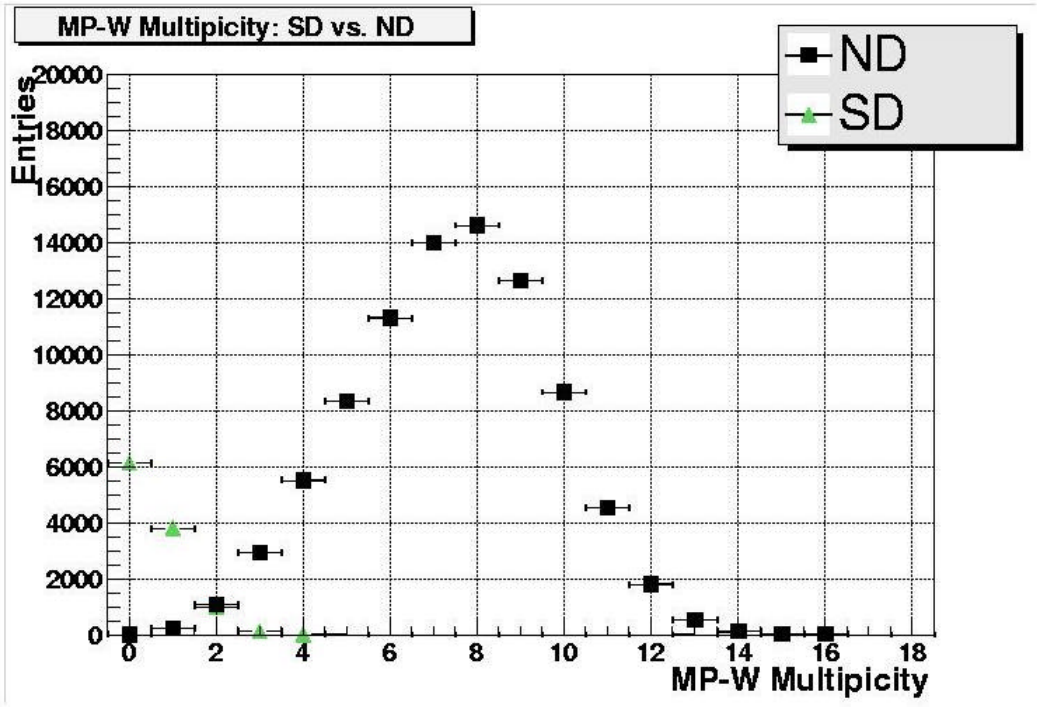
⇨ **Diffractive dijets are boosted away from the recoil antiproton**

Df (jet_1-jet_2)



⇨ **Diffractive dijets are more back to back**

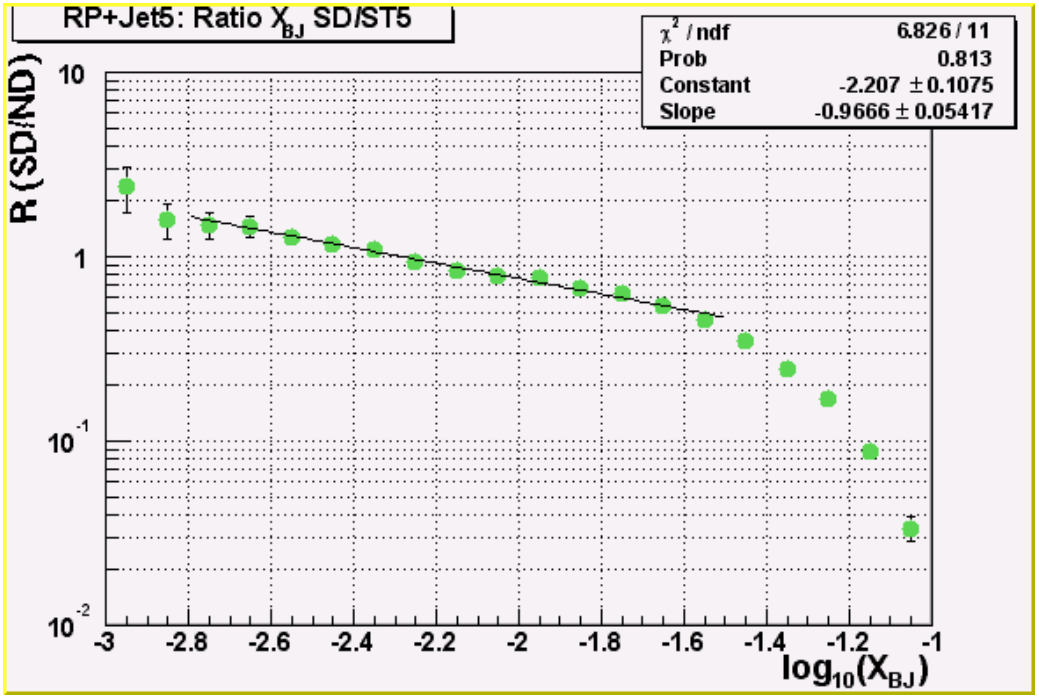
MP Multiplicity

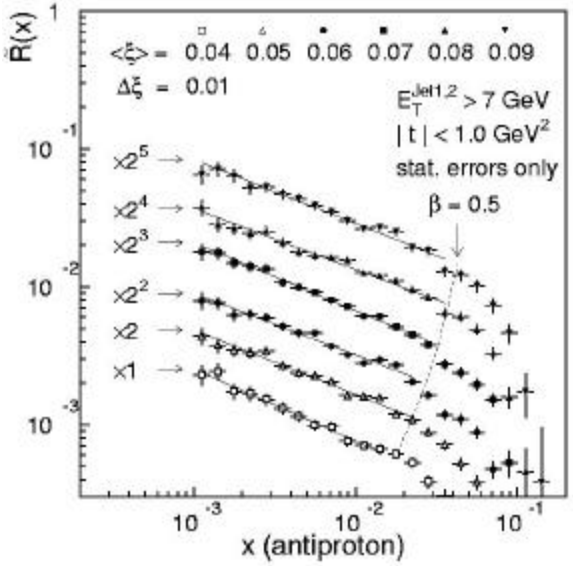


- **SD and ND**

Structure Function

- $x = S_{1,2,3}\, e^{-h} / \sqrt{s}$
- Ratio SD/ND
- $E_T(jet_{1,2,3}) > 5$ GeV





⇦ Run I PRL (b=0.45)

Fit to $dR/dx \sim 1/x^b$
⇨ b = 0.43

Conclusions

- Measurement of diffractive structure function
- Good agreement with Run I results
- Extend to higher q^2 and lower x
- Other samples under study (Gap+Jet, ...)
- Work on DPE in progress
- Updated triggers soon (forward jets, …)